



Assessment of Dipstick and Urine Sediment Examination Results on Pathological Urine Color

Putu Ayu Parwati^{1*}, Anak Agung Ayu Eka Cahyani², Lia Cahya Sari³, Diah Prihatiningsih⁴
1,2,3,4 Applied Bachelor's Degree Program In Medical Laboratory Technology
Wira Medika Bali College of Health Sciences

*Corresponding author: ayuparwati@stikeswiramedika.ac.id

Received:
July 7, 2025

Revised:
July 14, 2025

Accepted:
July 31, 2025

Published:
October 6, 2025

Abstract

Urine is a waste fluid excreted by the kidneys and eliminated from the body through urination. The composition of urine can reflect the kidney's ability to retain and reabsorb substances essential for basic metabolism and maintaining the body's homeostasis. Abnormalities in urine color, clarity, and turbidity may indicate conditions such as infection, dehydration, hematuria, liver disease, or muscle and erythrocyte damage. This study aimed to assess the results of dipstick and urine sediment examinations in relation to pathological urine color. An analytical study with an experimental approach was conducted at Wira Medika Bali College of Health Sciences Laboratory from April to June 2024. Fifteen pathological urine samples from clinical laboratories in Denpasar were examined, with each tested in duplicate. Samples were examined macroscopically, using dipstick tests, and urine sediment analysis. The examination results were compared with the pathological urine colors. The study found that brown-colored urine showed positive results for erythrocytes and bacteria; red-colored urine showed positive results for erythrocytes, leukocytes, epithelial cells, and bacteria; yellowish-brown urine showed positive results for erythrocytes and leukocytes. It was also found that turbid urine showed positive results for erythrocytes, leukocytes, epithelial cells, and bacteria, while slightly turbid urine showed positive results for erythrocytes and leukocytes. In contrast, clear and transparent urine showed no organic or inorganic components. These findings indicated that urine color and turbidity can reflect the presence of components in the urine, making macroscopic urine examination a useful preliminary indicator in detecting urinary tract disorders or infections.

Key words: Dipstick, Macroscopic Urine, Urine Color, Urine Sediment

1. Introduction

Urine is the residual fluid resulting from kidney excretion that exits the body through the process of urination. The function of urination is to eliminate waste molecules from the blood that have been filtered by the kidneys and to maintain the body's fluid balance. The composition of urine reflects the kidney's ability to retain and absorb essential substances for basic metabolism and to sustain the body's homeostasis [1]. Under normal conditions, freshly voided urine appears



yellow due to the pigments urochrome and urobilin, with clarity ranging from clear to slightly cloudy. The color intensity of urine depends heavily on its concentration; dilute urine is nearly colorless, whereas concentrated urine exhibits a dark yellow or amber hue [2].

Changes in urine color, clarity, and turbidity can indicate disorders such as infection, dehydration, blood in the urine (hematuria), liver disease, muscle damage, or the presence of red blood cells in the blood [3]. Organs involved in urine formation include the blood transport system, liver, urinary tract, bile ducts, kidneys, bladder, and urethra. The blood transport system plays a crucial role in determining the color of urine; clearer the urine color, the greater the likelihood that there are some disorders in this system. According to Ibnu Sina, the liver has a significant role in maintaining urine neutrality related to sedimentation and the red coloration of urine, while the kidneys also influence urine color, whether red or black [4].

The causes of urine coloration vary; for example, yellow coloration is due to bilirubin. Green urine is usually the results from bacteria such as *Pseudomonas aeruginosa* (*B. pyocyaneus*), while red urine may come from hemoglobin, porphyrin, porphobilin, or bacteria like *B. prodigiosus*. Brown urine is caused by bilirubin, hematin, and porphobilin; dark brown or black urine may be the result from old blood, alkapton, and melanin. Milky-colored urine can be caused by pus, prostatic secretions, chyle, lipids, bacteria, or precipitated proteins [5].

In the laboratory, urine examination not only provides information about the kidneys and urinary tract but also offers insight into the function of other organs such as the liver, bile ducts, and pancreas. A complete urine test is known as urinalysis, which is one of the most frequently performed tests because of its convenience in collecting sample and simple examination procedures [6]. The most common method used for chemical urine testing is the dipstick or test strip method, which reveals a range of chemical constituents in the urine through color changes [7].

The dipstick method has function as a basic diagnostic tool to detect pathological changes in urine by observing color changes that correspond to the urine's condition. Additionally, urine sediment examination is also part of the comprehensive urine analysis. Based on the statement above, this study aims to assess the results of dipstick and urine sediment examinations in relation to pathological urine color.



2. Method

This study employed an analytical research design with an experimental approach aimed at assessing and comparing the results of dipstick and urine sediment examinations against pathological urine color. The examinations were conducted at the Laboratory of Wira Medika Bali College of Health Sciences from April to June 2024. The population in this study were all urine samples examined in clinical laboratories in the Denpasar area.

The study sample consisted of 15 pathological urine samples collected randomly. Each sample was tested twice, resulting in a total of 30 examination units.

The independent variables in this study were results from dipstick and urine sediment examinations, while the dependent variable was pathological urine color as observed macroscopically. The research equipment and materials included a test tube rack, microscope, centrifuge, centrifuge tubes, micropipettes, cover slips, glass slides, sterile urine containers, yellow tips, dipstick strips, and pathological urine samples.

The pre-analytical phase involved greeting respondents, confirming their identity, preparing the necessary tools and materials, and instructing respondents on proper midstream urine collection techniques, including handwashing and genital cleaning. After collection, urine samples were transported to the laboratory for examination.

During the analytical phase, urine samples underwent macroscopic examination by observing color, odor, pH, specific gravity, and clarity to provide initial indications of kidney, liver disease, or urinary tract infections. Dipstick tests were performed by immersing the strips in homogenized urine samples, removing excess urine, and reading the results according to the provided color chart. Urine sediment examination involved centrifuging samples, collecting sediments, and microscopic examination to detected red blood cells, leukocytes, epithelial cells, crystals, and bacteria.

In the post-analytical phase, dipstick and sediment examination results were recorded and compared with the macroscopically observed pathological urine color. The collected datas were analyzed univariately to determine the frequency distribution of each variable.

The methods applied in this study adhered to standard procedures documented in relevant literature [8][7][6]. Any modifications or use of equipment with specific accuracy tolerances will be detailed to enable replication by future researchers.



3. Result and Discussion

3.1. Results

Tabel 1. Urine Examination Results

No	Color	Turbidity	Erythrocytes	Leukocytes	Epithelium	Crystals	Bacteria
1A	Brown	Clear	Full	Neg	Neg	Positive	Positive
1B	Brown	Clear	Full	Neg	Neg	Positive	Positive
2A	Brown	Cloudy	Pos	Pos	Neg	Positive	Positive
2B	Brown	Cloudy	Pos	Pos	Neg	Positive	Positive
3A	Brown	Clear	Full	Neg	Neg	Positive	Positive
3B	Brown	Clear	Full	Neg	Neg	Positive	Positive
4A	Red	Cloudy	Full	Full	Pos	Neg	Positive
4B	Red	Cloudy	Full	Full	Pos	Neg	Positive
5A	Clear	Clear	Neg	Neg	Neg	Neg	Neg
5B	Clear	Clear	Neg	Neg	Neg	Neg	Neg
6A	Clear	Clear	Neg	Neg	Neg	Neg	Neg
6B	Clear	Clear	Neg	Neg	Neg	Neg	Neg
7A	Yellowish-brown	Slightly Cloudy	Pos	Pos	Neg	Neg	Neg
7B	Yellowish-brown	Slightly Cloudy	Pos	Pos	Neg	Neg	Neg
8A	Yellowish-brown	Cloudy	Pos	Pos	Neg	Neg	Positive
8B	Yellowish-brown	Cloudy	Pos	Pos	Neg	Neg	Positive
9A	Yellowish-brown	Cloudy	Pos	Pos	Neg	Neg	Positive
9B	Yellowish-brown	Cloudy	Pos	Pos	Neg	Neg	Positive
10A	Yellowish-brown	Clear	Full	Full	Neg	Neg	Neg
10B	Yellowish-brown	Clear	Full	Full	Neg	Neg	Neg
11A	Yellowish-brown	Clear	Pos	Pos	Neg	Neg	Neg
11B	Yellowish-brown	Clear	Pos	Pos	Neg	Neg	Neg
12A	Yellowish-brown	Clear	Pos 1	Pos 1	Pos	Pos	Neg
12B	Yellowish-brown	Clear	Pos 1	Pos 1	Pos	Pos	Neg
13A	Yellowish-brown	Clear	Pos	Pos	Neg	Pos	Neg
13B	Yellowish-brown	Clear	Pos	Pos	Neg	Pos	Neg
14A	Yellowish-brown	Clear	Neg	Pos	Neg	Neg	Neg
14B	Yellowish-brown	Clear	Neg	Pos	Neg	Neg	Neg
15A	Yellowish-	Clear	Neg	Pos	Neg	Neg	Neg



No	Color	Turbidity	Erythrocytes	Leukocytes	Epithelium	Crystals	Bacteria
15B	brown Yellowish- brown	Clear	Neg	Pos	Neg	Neg	Neg

Notes :

- Pos = Positive
- Neg = Negative
- Full = Full or abundant
- Slightly Cloudy = Agak Keruh

Based on the table 1, the macroscopic examination of urine showed that 3 samples with brown color, 1 sample with red color, 2 samples clear, and 9 samples yellowish-brown. Regarding urine turbidity, 4 samples were cloudy, 1 sample slightly cloudy, and 10 samples clear.

The urine sediment examination revealed that 4 samples did not contain erythrocytes, while 11 samples tested were positive in erythrocytes. Leukocyte examination showed that were 11 positive samples and 4 samples were negative. Epithelial cell examination indicated 2 samples were positive and 13 samples were negative. Crystal examination revealed 5 samples were positive and 10 samples were negative. Meanwhile, bacteria were detected in 6 positive and 9 negative samples.

The study results showed that brown urine correlated with positive erythrocytes and bacteria in pathological urine. Red urine was connected with positive erythrocytes, leukocytes, epithelial cells, and bacteria. Yellowish-brown urine contained positive erythrocytes and leukocytes. Clear urine showed no organic or inorganic components.

Additionally, cloudy urine contained positive erythrocytes, leukocytes, epithelial cells, and bacteria. Slightly cloudy urine contained positive erythrocytes and leukocytes. Clear and transparent urine showed no organic or inorganic components.

3.2. Discussion

Urine is a biofluid that is resulted from the kidney's excretory functions, expelled through urination to remove metabolic waste products filtered from the blood and to maintain the fluid



balance and homeostasis of the body [1]. The capacity of the kidneys to retain and resorb essential substances directly affects urine composition, which reflects metabolic and physiological status.

Urine is formed and composed by a number of physiological systems and organs, including the liver, kidneys, bladder, urethra, bile duct, blood transport systems, and urinary tracts.

Blood transport, especially, plays a key role in determining urine color, as disturbances in these systems often manifest as visible color changes in urine. The philosopher Ibnu Sina notably emphasized the liver's critical role in determining urine neutrality, sediment characteristics, and red discoloration, while kidney pathology influences red and black urine coloration [4].

Normal fresh urine usually appears clear or slightly cloudy and exhibits a yellow color derived from urochrome and urobilin pigments. Urine color intensity has correlations with concentration; diluted urine is nearly colorless, while concentrated urine has a deep yellow-to-brownish hue [2]. Deviations from these normal features in color, clarity, or turbidity can signal infections, dehydration, hematuria (blood in urine), liver diseases, muscle damage, or presence of erythrocytes [3].

This study's findings emphasized such clinical interpretations: brown urine samples correlated positively with erythrocytes and bacterial presence in pathological urine. The brown color results from pigments such as bilirubin, hematin, and porphobilin, while darker brown or black shades are linked with degradation products like old blood, alkapton, or melanin. Moreover, milky or opaque urine appearances are associated with pus, prostatic secretions, chylous fluid, lipids, bacteria, and coagulated proteins [5].

Red urine specimens similarly demonstrated positive erythrocytes, leukocytes, epithelial cells, and bacteria, with the red hue deriving from hemoglobin, porphyrins, and porphobilin, or bacterial contaminants such as *B. Prodigiosus* [5]. Yellowish-brown urine samples also showed erythrocyte and leukocyte positivity, in line with bilirubinuria or other metabolic disturbances [5].

Clarity or turbidity of urine denotes the degree of transparency of the specimen. This parameter is assessed visually and alongside color during routine urinalysis. Terms describing clarity include clear, slightly cloudy, cloudy, and very cloudy/milky [8]. In this study, cloudy urine contained significant erythrocytes, leukocytes, epithelial cells, and bacteria indicative of pathological processes, whereas slightly cloudy urine specimens showed positivity primarily for erythrocytes and leukocytes. Clear urine samples lacked organic and inorganic sediment, suggesting physiological urine without pathological changes. The causes of turbidity are diverse,



commonly including bacterial overgrowth, inflammation cells (leukocytes, erythrocytes), lymphatic fluid, lipid droplets, mucus, yeasts, crystals, and amorphous salts [8].

These results underscored the value of combined dipstick and sediment examination for identifying pathological changes reflected in urine color and clarity. The strong correlation between macroscopic observations and microscopic sediment findings supports the diagnostic utility of color and appearance assessment in initial urine screening.

Clinically, such urine abnormalities can assist in early detection of urinary tract infections (UTIs), hematuria from renal or urologic sources, and hepatobiliary diseases. Because dipstick tests are quick, easy, and affordable, it is still essential for regular laboratory and clinical evaluations [7]. However, sediment urine examination provides further detail, especially in distinguishing types and quantities of formed elements, supporting more accurate diagnosis and patient management.

Despite the valuable findings, limitations such as the sample size was relatively small and lack of specific bacterial cultures in this study suggest opportunities for expanded future research. Inclusion of quantitative analysis, additional biomarkers, and correlation with clinical symptoms would enrich understanding of urine color changes related to pathology.

Overall, the integration of urine dipstick analysis and sediment examination provides a comprehensive approach to assessing pathological urine changes and can guide appropriate clinical interventions.

4. Conclusion

Based on the results of this study, it can be concluded that pathological urine samples exhibiting a brown color are associated with the presence of erythrocytes and bacteria. Urine samples with a red color showed positive results for erythrocytes, leukocytes, epithelial cells, and bacteria, indicating pathological conditions. Meanwhile, urine with a yellowish-brown color revealed the presence of erythrocytes and leukocytes. Furthermore, cloudy urine corresponded to positive findings of erythrocytes, leukocytes, epithelial cells, and bacteria, while slightly cloudy urine mainly shows erythrocytes and leukocytes positivity. In contrast, clear and transparent urine samples did not contain any organic or inorganic elements. These findings emphasized the importance of evaluating urine colour and clarity alongside dipstick and sediment tests as effective indicators for identifying pathological alterations in the urinary system.



5. Acknowledgement

Acknowledgements are sincerely extended to Wira Medika Bali College of Health Sciences, especially to the PPPM (Center for Research and Community Service) of Wira Medika Bali College of Health Sciences, for providing the facilities and support that enabled the smooth conduct of this research. Sincere thanks are also extended to the respondents who willingly participated in this study.

6. References

- [1] M. Sapti, "Kemampuan Koneksi Matematis (Tinjauan Terhadap Pendekatan Pembelajaran SAVI)," *Limit*, vol. 53, no. 9, p. 10, 2019.
- [2] A. A. Hidayat, T. Anggraini, Y. and R. Chadry, "Pembuatan Histogram dan Pola Data Warna Urin Berdasarkan Urinalisis Menggunakan Mini PC," *Jurnal Resti*, vol. 2, no. 3, pp. 722-727, 2018.
- [3] V. F. Dahlika, N. Ningsih, R. Flora and L. , "Pengaruh Latihan Fisik Aerobik Terhadap Warna dan Kejernihan Urin Pada Penderita Hipertensi," *Jurnal Kesehatan Poltekkes Palembang*, vol. 15, no. 1, pp. 1-6, 2020.
- [4] Wahidi and O. Sopari, "Konsep Urin Menurut Ibnu Sina : Kajian atas Kitab al-Qanuun fifth-Thibb," *Jurnal Pendidikan Islam*, vol. 4, no. 2, pp. 339-372, Desember 2015.
- [5] Gandasoebrata, *Penuntun Laboratorium Klinik*, Jakarta: Dian Rakyat, 2006.
- [6] W. O. Asriyani, "Perbedaan Hasil Pemeriksaan Sedimen Urine yang Diperiksa Kurang dari 1 JAm dan Lebih dari 1 Jam pada Pasien Suspek Infeksi Saluran Kemih di RSUD Kota Kendari," *Jurusan Analis Kesehatan, Politeknik Kesehatan Kendari, Kendari*, 2016.
- [7] B. N. Israeli, M. W. Diarti and Y. A. Jiwantoro, "Pemanfaatan Larutan Garam Natrium Klorida (NaCL) Sebagai Pengawet Alternatif Pada Urine Untuk Pemeriksaan Urine Metode Carik Celup," *Jurnal Analis Medika Bio Sains*, vol. 6, no. 2, 2019.
- [8] R. d. Mohammad, *Urinalisis : Menerjemahkan Pesan Klinis Urin*, Pustaka Rasmedia, 2015.